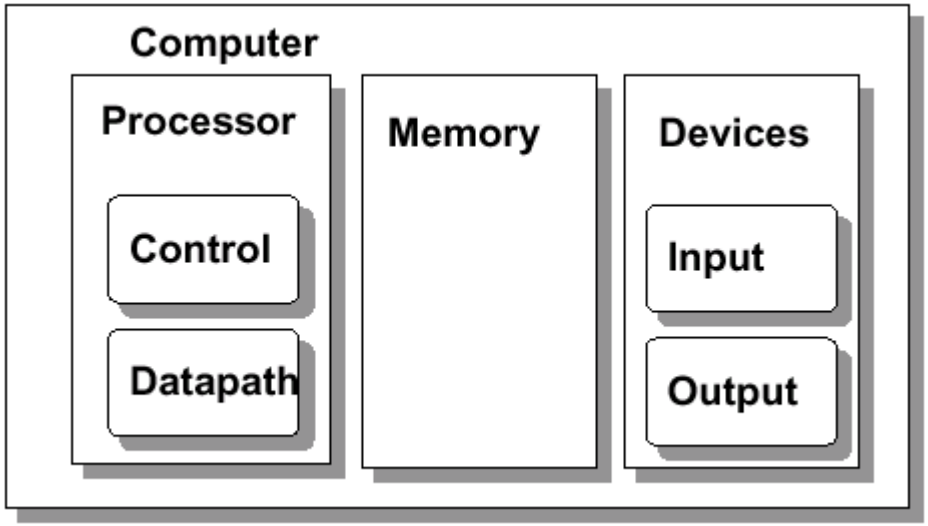
January 11

- Books?
- Email?
- Admission?
- You GOTTA read your email!
- Accounts?

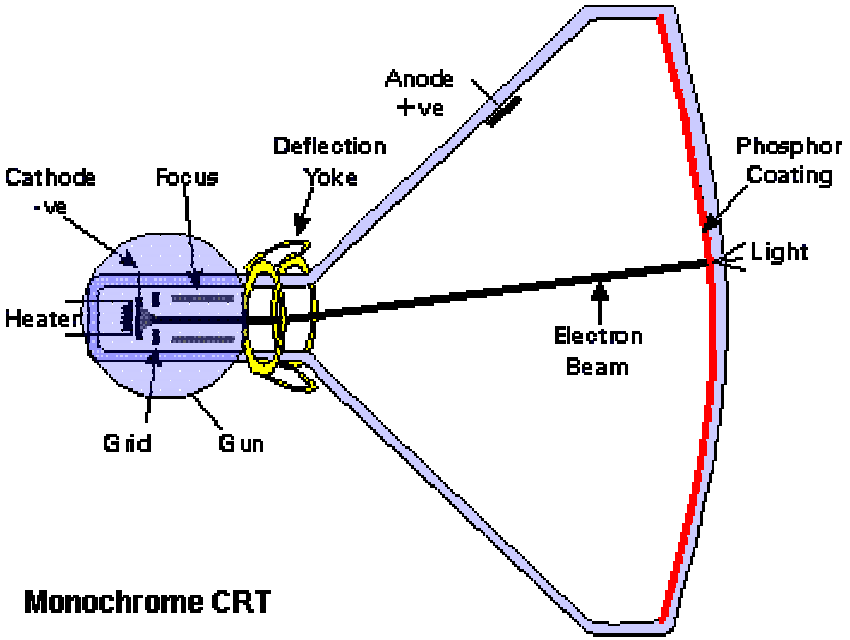
What does a computer look like?

- Tape drives?
- Big box with lots of lights?
- Display with huge letters?
- Little box with no lights?
- Lump in the cable?

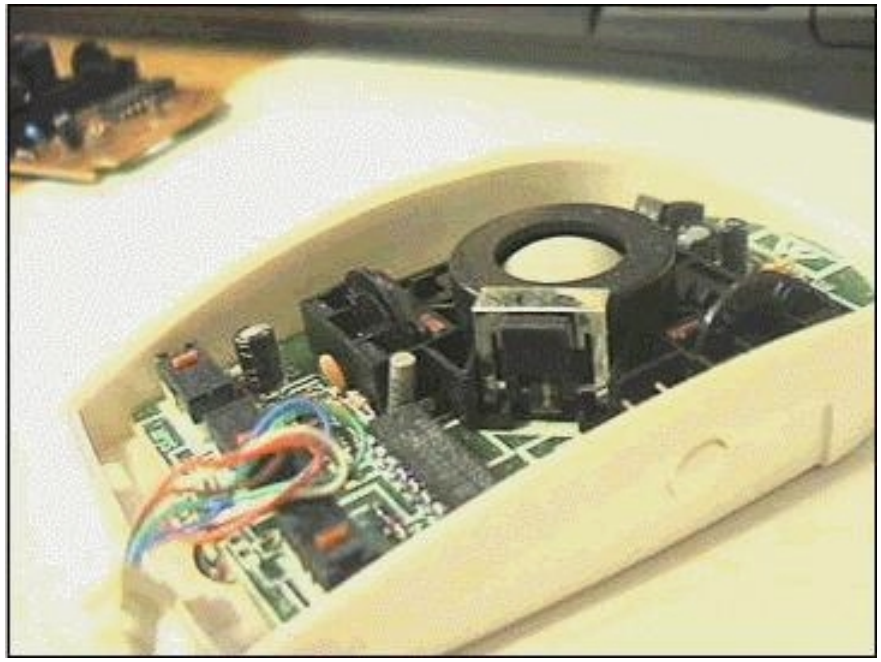
5 Classic Computer Components



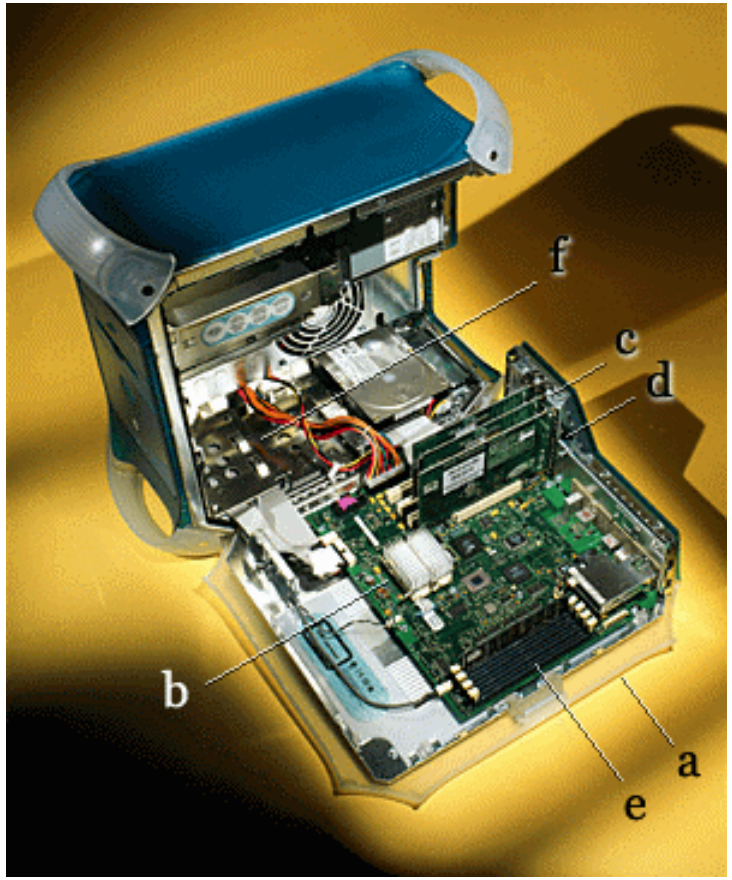
Display


Anode
+ve
Deflection
Yoke
Phosphor
Coating
Cathode
-ve
Focus
Light
Heater
Electron
Beam
Grid
Gun
Monochrome CRT

Mouse



Inside the case

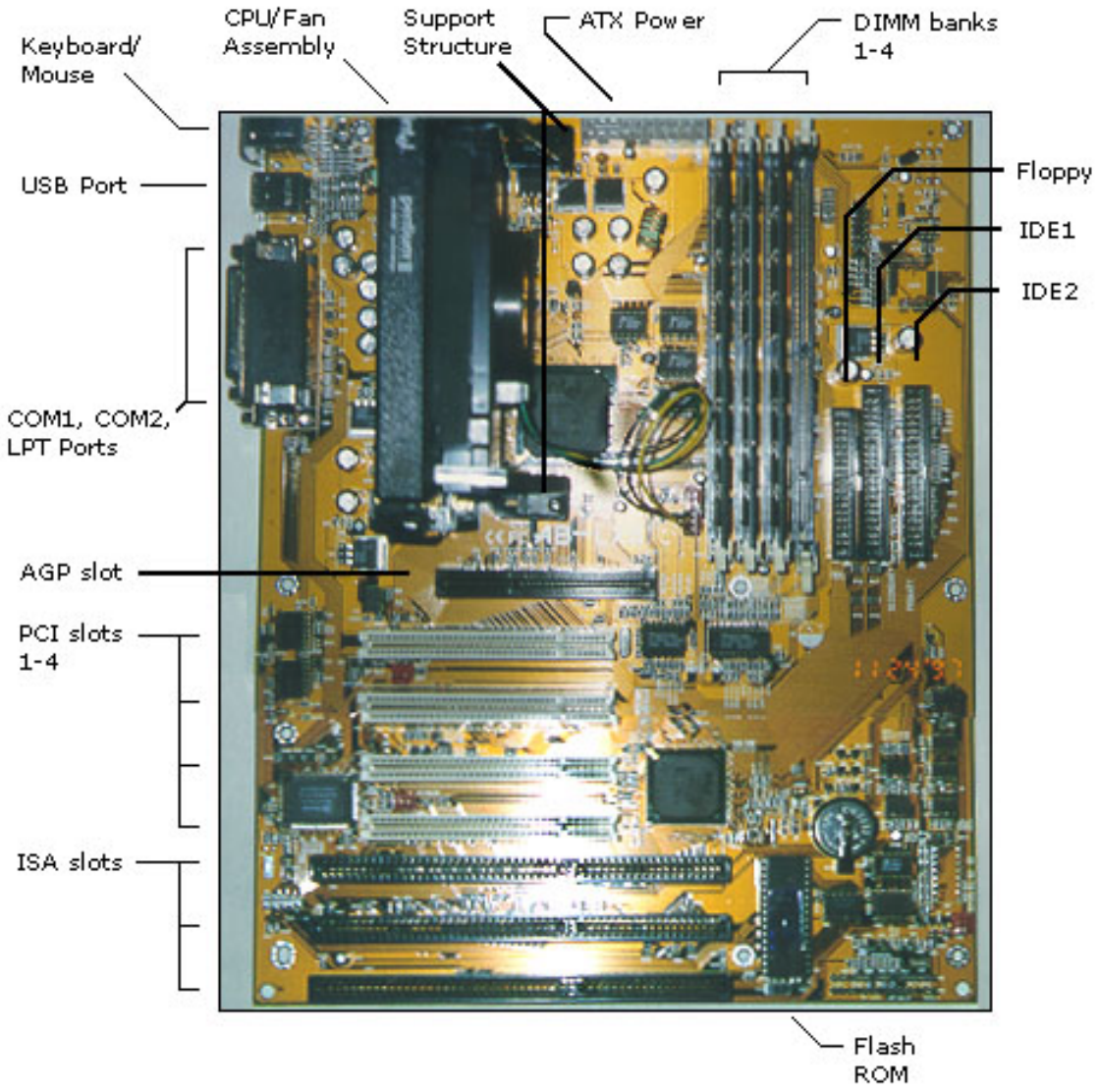


b. Processor

c. PCI slots

e. Memory slots

Motherboard

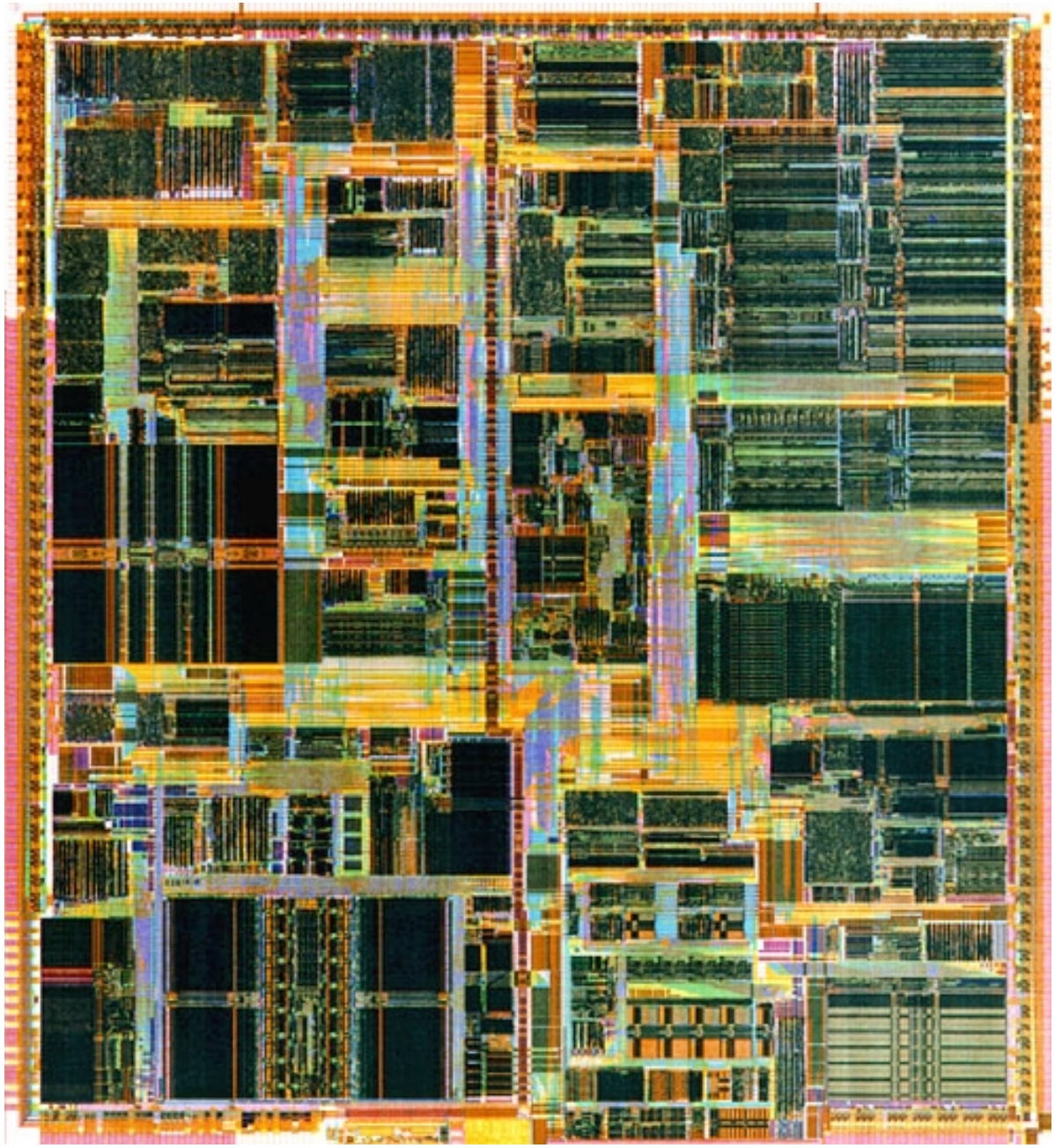


Memory

- RAM
- DRAM
- SRAM
- ROM
- Volatile / Non-Volatile
- Magnetic

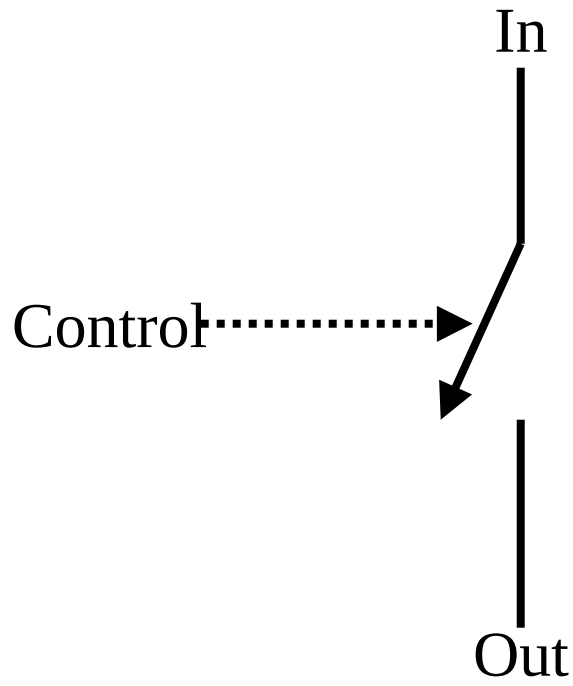
Processor

Pentium III Xeon

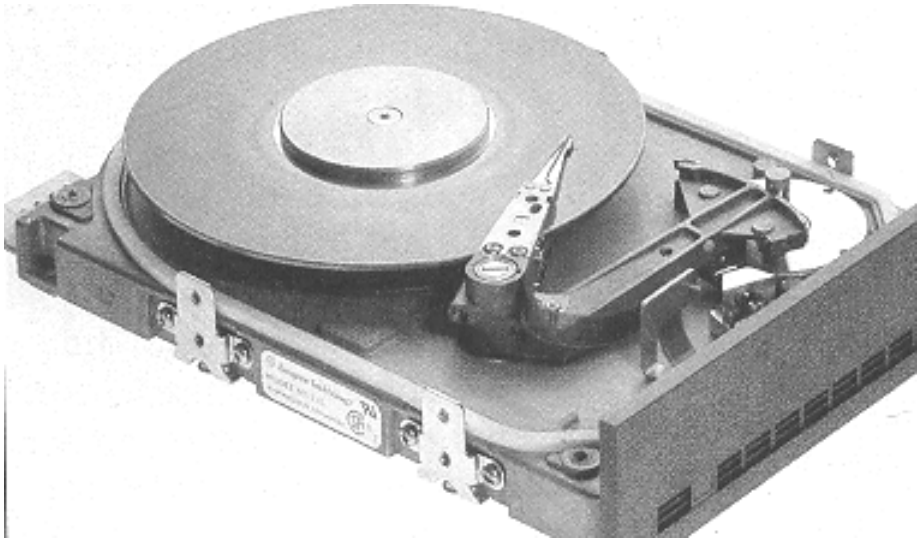


You only need switches and wires!

- Relays
- Vacuum tubes
- Transistors
- Integrated Circuits
- VLSI
- Nanotubes?
- Quantum Effect Devices?



Hard Drive

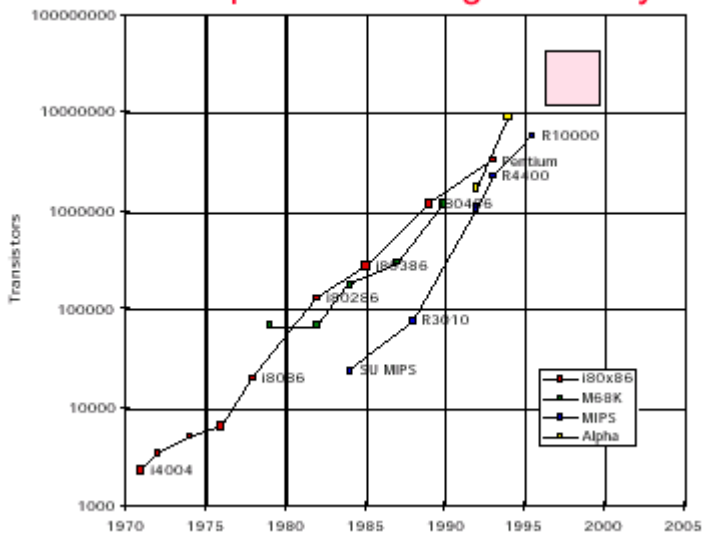


Improving Technology

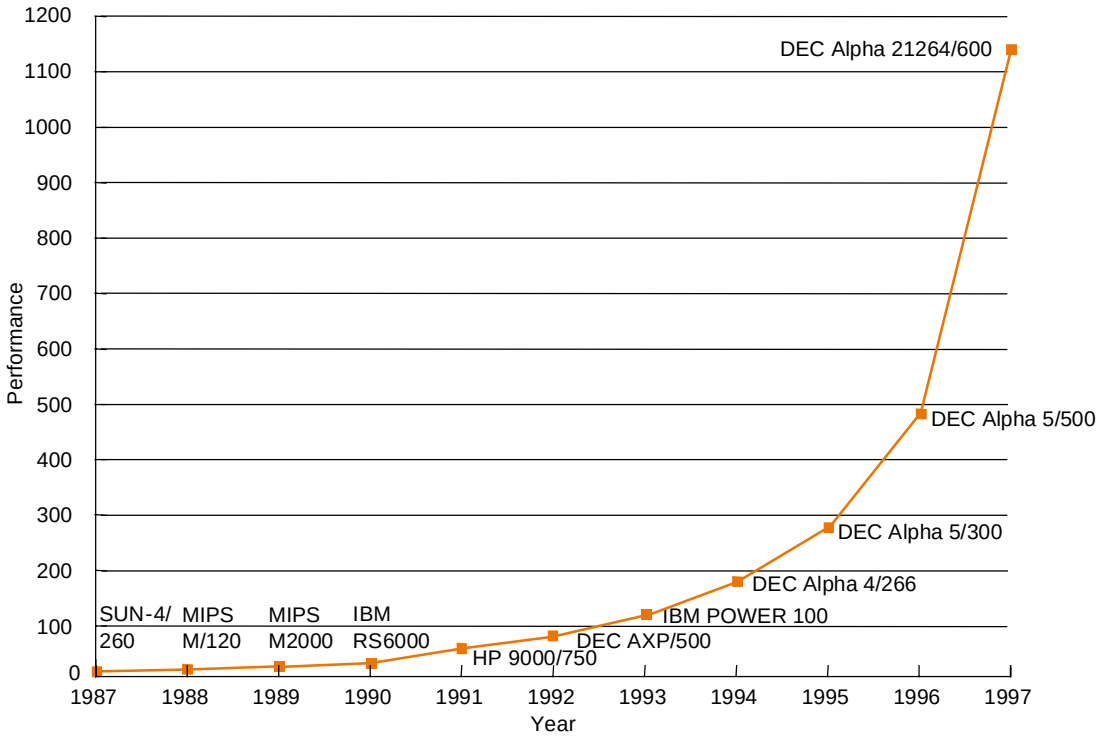
DRAM chip capacity

DRAM	
Year	Size
1980	64 Kb
1983	256 Kb
1986	1 Mb
1989	4 Mb
1992	16 Mb
1996	64 Mb
1999	256 Mb
2002	1 Gb

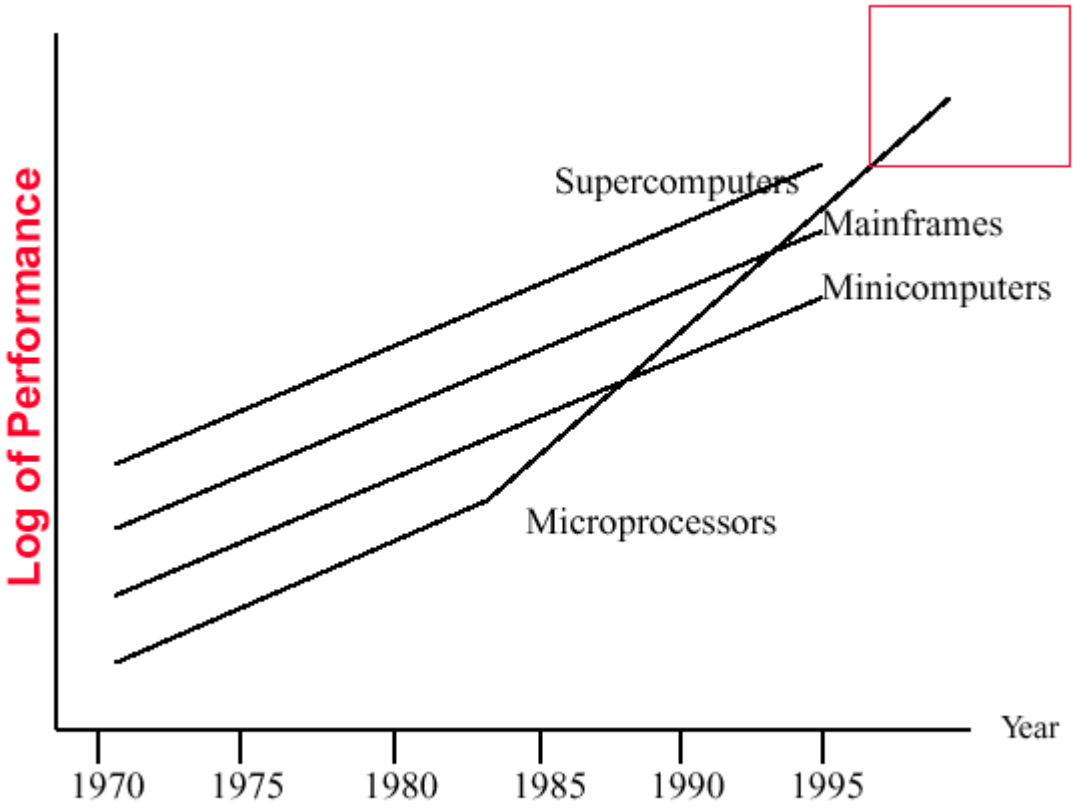
Microprocessor Logic Density



Performance Increase

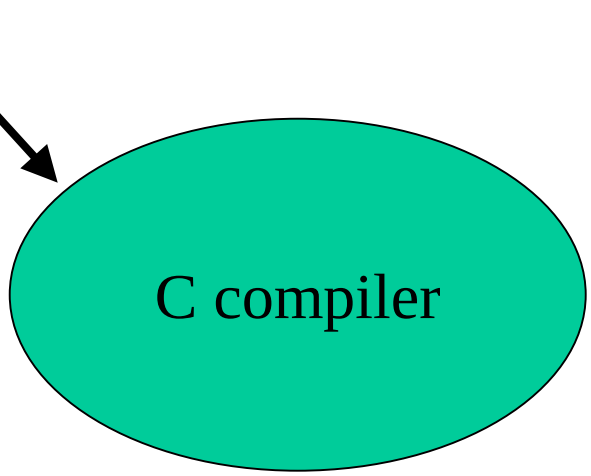


Performance Trends



Abstraction: C to ASM

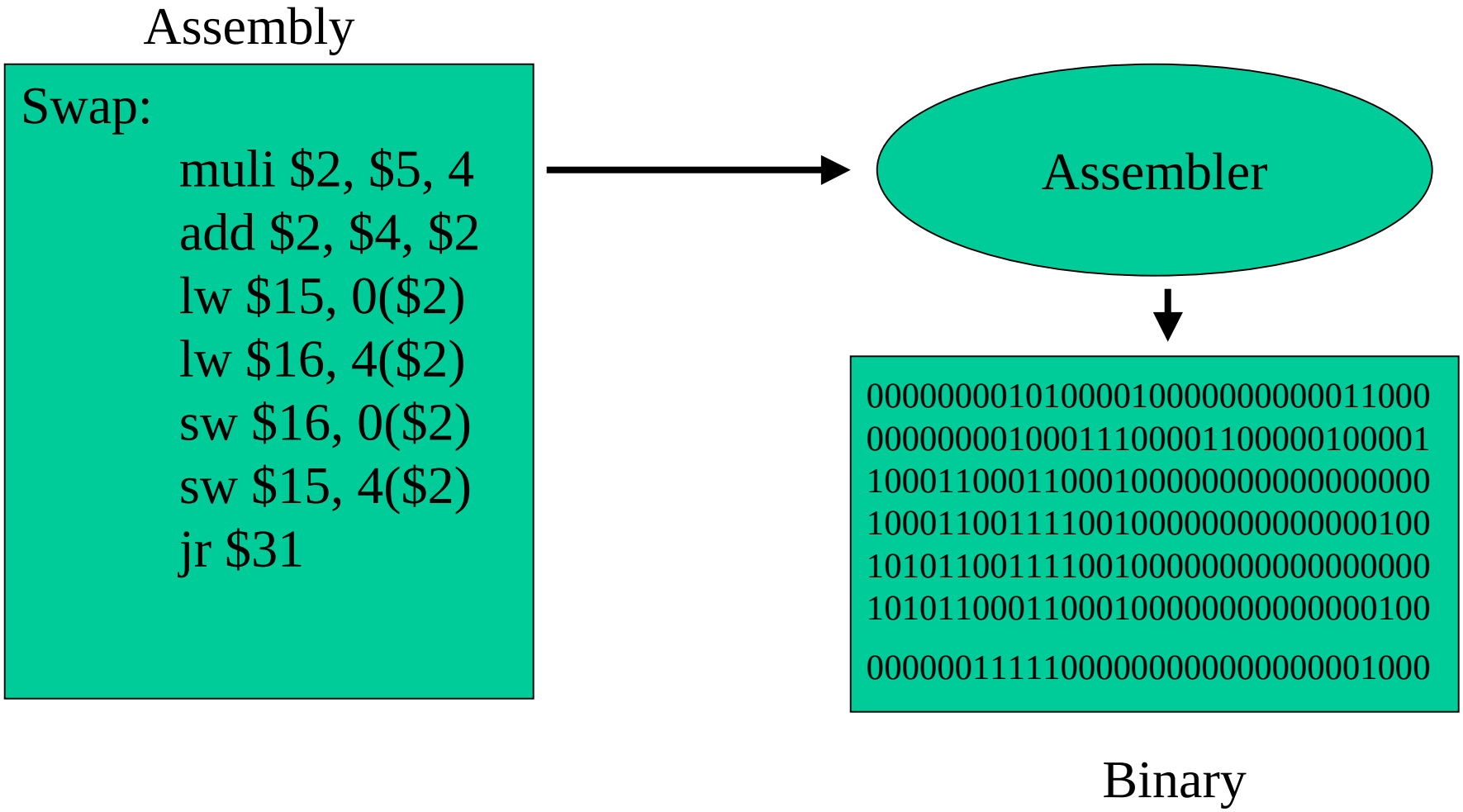
```
Swap(int v[], int k) {
  int temp;
  temp = v[k]; v[k] = v[k+1]; v[k+1] = temp;
}
```



Assembly

```
Swap:
        muli $2, $5, 4
        add $2, $4, $2
        lw $15, 0($2)
        lw $16, 4($2)
        sw $16, 0($2)
        sw $15, 4($2)
        jr $31
```

Abstraction: ASM to Binary



Instruction Set Architecture

... the attributes of a [computing] system as seen by the programmer, *i.e.* the conceptual structure and functional behavior, as distinct from the organization of the data flows and controls, the logic design, and the physical implementation.

– Amdahl, Blaaw, and Brooks, 1964

- interface between hardware and low-level software
- standardizes instructions, machine language bit patterns, etc.
- advantage: *different implementations of the same architecture*
- disadvantage: *sometimes prevents using new innovations*

  Modern instruction set architectures:
  - 80x86/Pentium/K6, PowerPC, DEC Alpha, MIPS, SPARC, HP

Where we are headed

- Performance issues (Chapter 2) *vocabulary and motivation*
- A specific instruction set architecture (Chapter 3) **Why MIPS? Why not Intel?**
- Arithmetic and how to build an ALU (Chapter 4)
- Memory: caches and virtual memory (Chapter 7)
- Pipelining to improve performance (Chapter 6) *briefly*
- I/O (Chapter 8) *briefly*

Key to a good grade: reading the book!